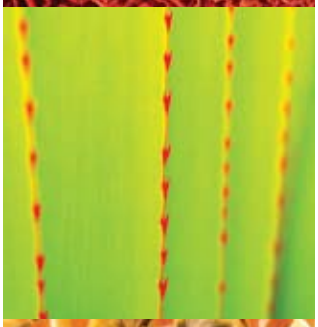
ECOREGION: GREAT LAKES



Viewed from outer space, the Great Lakes resemble five fingers spanning the border between Canada and the United States.

Due to the sheer size of these water bodies and the fact that they are landlocked, the Great Lakes create their own weather patterns. For example, cold air masses moving across the warm lake surfaces often result in increased snow or rainfall in the lake region.[1] In the northern parts of these vast lakes, the climate is cold and the landscape is dominated by **conifer** trees. As the lakes extend south into the United States, the climate becomes warmer and the soils more fertile. These forests contain **deciduous** trees, which fill the region with brilliant colors in autumn before losing their leaves. Because the weather is warmer and the soils are more fertile, much of the southern Great Lakes region contains farms, cities, and towns. For example, Chicago is located in the southern basin of Lake Michigan.[2]

Formed over a million years ago by massive glaciers, Lake Michigan, Lake Erie, Lake Huron, Lake Superior, and Lake Ontario contain roughly 18% of the world's fresh water.[3] In addition to providing drinking water to people, the lakes also sustain diverse ecosystems. Fish species such as lake trout and salmon live in the rivers and lakes of the region, while birds and mammals make their homes in the surrounding wetlands and forests. The grey wolf, moose, black bear, peregrine falcon and bald eagle all live in the marshy wetlands and deep forests of this ecoregion.

IMPACTS OF CLIMATE CHANGE

Scientists predict that climate change will make the Great Lakes ecoregion substantially warmer and drier.[4] The lakes themselves are likely to become warmer and the surface of the lake water is expected to drop due to increased **evaporation**.[5,6,7] In fact, the region is already warmer than it was fifty years ago[8] and Lake Superior has warmed by 2.5°C (4.5°F) since 1980.[9] **Climate models** also predict that spring will arrive earlier and that rivers may flood more frequently due to increased heavy rainfall in some areas.[10]

The warmer water and air temperatures are likely to affect the habitats of many species living in the Great Lakes region, and may cause some species to migrate or die off in the region. Coldwater fish such as lake trout, for example, are adapted to very cold water with a high oxygen content. As the water warms, these fish will have to move into deeper and colder water in order to survive. Similarly, as air temperatures increase, tree species adapted to cold climates (such as many conifers) may migrate north. As this migration occurs, the forest region surrounding the Great Lakes may become increasingly dominated by deciduous species such as the sugar maple.[11]

Climate change will also stress communities of species throughout the Great Lakes region that have evolved to rely on each other. Species that use temperature cues to tell them when to nest, reproduce, or bloom will begin these life cycle events at different times of year, sometimes with disastrous consequences for the entire **food web**. For example, migratory birds such as scarlet tanagers, warblers, thrushes, and flycatchers may be at risk in the Great Lakes region if other bird species begin laying eggs and consuming resources before these migratory birds even arrive.[12] Climate change is likely to affect ecological relationships such as these across the entire Great Lakes ecoregion.

SPOTLIGHT ON A SPECIES

Lake trout, *Salvelinus namaycush*, are a popular fish to catch in the Great Lakes because they can grow to be very large and are delicious to eat. One of the largest lake trout ever caught in the Great Lakes was reeled in from Lake Superior weighing 63 pounds![13] Lake trout prefer very cold water and are often found swimming in the deepest parts of the Great Lakes. As adults, they usually eat other fish and are formidable hunters. A lake trout can dive down into the lake very quickly by "burping" out air from its swim bladder, a strategy similar to that used by scuba divers to control their position in the water.[14]

Historical records indicate that lake trout were once abundant in the deepest waters of the Great Lakes. In the 1980s, Lake Huron fishers caught an average of 7.4 million pounds of lake trout per year, while Lake Michigan averaged 3 million pounds per year.[15] Today, the Great Lakes region remains a popular fishing destination, but populations of lake trout have severely decreased due to competition from invasive species, pollution, and overfishing.[16,17] Climate change is expected to further stress lake trout by warming the lakes and reducing the amount of coldwater habitat available. In addition, invasive fish species such as the alewife, round goby, and sea lamprey may benefit from warmer temperatures because the cold water will no longer prevent them from expanding into new habitats. If these invasive species move into new territories, they will compete for food with native coldwater species such as lake trout and yellow perch.[18] Even species that are currently native to the warmer, southern regions of the Great Lakes may pose a problem. For example, climate models predict that smallmouth bass will expand northward as temperatures warm, perhaps invading lake trout territories.[19]

Scientists study lake trout and other coldwater fish because these species are particularly sensitive to the effects of climate change and can serve as indicators of the general health of the ecosystem. Although it is possible that coldwater fish might be able to migrate away from or adapt to warming waters, the added pressures of overfishing, invasive species, pollution, and shipping will make adaptation and migration very difficult.[20] In addition, bears, eagles, and other predators depend on fish for food, meaning that declines in coldwater fish species will affect the entire Great Lakes regional ecosystem.

PROFILING A CLIMATE STEWARD

Healthy ecosystems can better survive the impacts of climate change and continue to provide many recreational/commercial opportunities. Citizens can contribute to the health of cold-water lakes and streams, including the cold-water fish populations living in them, by taking such actions as restoring native plants to the region, adhering to legal catch limits of cold-water fish (or applying catch and release principles), and minimizing the use of motor-powered boats in large and small lakes.

The Environmental Protection Agency's regional office in Chicago, Illinois, sponsors the Greenacres Project as part of their Great Lakes program to enable citizens to help keep their surrounding ecosystems healthy. The project encourages communities, businesses, organizations, schools and individuals to use native plants in their landscaping to significantly reduce the need for fertilizers, pesticides, water, and motorized lawn maintenance equipment. Fertilizer often ends up in water sources and depletes oxygen in the water, harms aquatic life, and interferes with recreational uses. Pesticides run off lawns and contaminate rivers and lakes. Lawn irrigation uses high percentages of the water consumption in most areas. Because of this high level of maintenance required for lawns, native plants provide a hardy, drought resistant, beautiful, and environmentally friendly replacement for lawns.

The deep root systems of many native Midwestern plants use less water, increase the soil's capacity to store water, and reduce runoff. Native plants also help reduce air pollution and global warming because they do not require mowing. Gas powered garden tools emit 5% of the nation's air pollution and contribute greenhouse gas emissions that cause global warming. Finally, native plants provide shelter and food for wildlife. Closely mowed lawns are of little use to most wildlife. Natural landscaping is an opportunity to reestablish diverse native plants, thereby inviting the birds and butterflies back home. Amundsen High School in Chicago

recognized its lawn space as an opportunity to reduce its impact on the environment. The school, which has "Enhance Environmental Awareness" as part of its mission, set a goal to reduce its lawn area by 50% and has almost reached this goal! With the initial work supported by the Chicago Department of the Environment and the Urban Greening Fund of the University of Illinois Cooperative Extension Service, the school has implemented projects like a prairie restoration, a wildflower garden, a butterfly/hummingbird garden, and the planting of trees and shrubs to provide habitats and food for wildlife. The native landscaping at the school currently includes a fenced prairie restoration area that contains over 50 native species, such as big bluestem, prairie dropseed, rattlesnake master, bee balm, and prairie roses. In 2008, the school added an outdoor classroom and restored the newly named Constance Gaberik Butterfly Garden and Dr. Edward T. Klunk Prairie.

Students take part in the beneficial landscaping by growing plants from seed that they then transfer outside, weeding, pruning, mulching, collecting trash, building fences, posting signs, and providing other day-to-day maintenance. In doing so, students have developed a sense of ownership and pride for their achievements. These programs have not only engaged the student body, but Amundsen has also received positive reactions from the community, including an award from the local gardening club and Mayor Richard J. Daley. Overall, the beneficial landscaping at Amundsen is a huge success and their advice to others considering using native landscaping, is "just get planting."

For more information on Amundsen High School's initiatives, please contact Jim Doyiakos at JDDoyiakos@cps.edu

FOR MORE INFORMATION

- The Intergovernmental Panel on Climate Change (IPCC) is the definitive source of unbiased climate change science. www.ipcc-wg2.org/index.html
- This detailed report focuses on how climate change and other stressors will affect the Great Lakes region. Kling , G.W., K. Hayhoe, L.B. Johnson, J.J. Magnuson, S. Polasky, S.K. Robinson, B.J. Shuter, M.M. Wander, D.J. Wuebbles, D.R. Zak, R.L. Lindroth, S.C. Moser, and M.L. Wilson. 2003. *Confronting climate change in the Great Lakes Region.* Union of Concerned Scientists, Cambridge, Massachusetts, and Ecological Society of America, Washington, D.C. http://www.ucsusa.org/assets/documents/global_warming/greatlakes_final.pdf
- This report contains information on how climate change may affect freshwater fishing across the United States. U.S. Environmental Protection Agency (USEPA), April 1995, *Ecological Impacts from Climate Change: An Economic Analysis of Freshwater Recreational Fishing.*
- This website contains general information on the Great Lakes, as well as specific resources on how climate change is expected to affect this ecoregion. US EPA Great Lakes website, http://www.epa.gov/glnpo/atlas/glat-ch2.html
- This report focuses on how climate change and other stressors will affect the Great Lakes region. U.S. Global Change Research Program (USGCRP). October 2000. *Preparing for a Changing Climate: Great Lakes Overview.* http://www.geo.msu.edu/glra/assessment/assessment_glraReport.htm

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